March 2021

Dynamic Content Insertion within an App Content Stream via Context Aggregation

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ABSTRACT

Apps that stream content often interleave the personalized content broadcast with other information, such as advertisements, announcements, etc. Personalized and contextually optimal selection of such additional content is currently constrained by the information available to the specific app provider. This disclosure describes a context aggregator service that app makers can query to enhance the selection of inserted content by querying a broad variety of relevant contextual information, obtained with user permission. The context aggregator service can utilize individual and/or aggregated information to provide query responses, e.g., topics or advertisements that a user is likely to be interested in. If the user permits, the context aggregator service can further determine advertising conversion based on subsequent user actions and use the conversion metrics in interest score calculations.

KEYWORDS

- Streaming content
- Advertising
- Contextual information
- Ad conversion
- Geographic cell

BACKGROUND

Users often consume personalized media content via apps that stream such content to their devices. For instance, users can use an app to listen to music. Such apps often interleave the personalized content broadcast with other information, such as advertisements, announcements, etc. Typically, such additional content is inserted within the user's personalized media stream at

opportune times, such as the end of a song or other item. The inserted additional content, such as an advertisement, is usually composed of a collection of such content created via agreements with various businesses or content providers. The specific content delivered to the user can be selected from the collection based on user-permitted information about the user and the user's context known to the provider of the streaming.

However, such personalized and contextually optimal selection of additional content, such as advertising, is necessarily constrained by the information available to the specific app provider. As a result, the content cannot leverage relevant information of potential interest to the user if that information falls outside the scope of the data available to the app. For example, advertisements served within an app that delivers streaming content to the entertainment system in a vehicle cannot be customized based on relevant vehicle information, such as location, fuel level, route, etc.

DESCRIPTION

This disclosure describes a context aggregator service that app makers can use to enhance the selection of inserted content by querying a broad variety of relevant contextual information, obtained and provided with user permission. If users permit, the service can aggregate a broad variety of contextual information, such as:

- **History:** Past user actions such as destinations, reservations, shopping, online search, etc.
- **Location:** Information connected to the user's past and current locations such as mode of travel, coordinates, direction, speed, routes, routines, etc.
- **Time:** Temporal information such as calendar events, time of day, day of the week, ongoing nearby events, current local trends, etc.

With user permission, such information can pertain to an individual user or can be aggregated across users that match specific criteria, such as users currently present within a given geographical region. To that end, context aggregation involves mapping user preferences and actions by subdividing the physical world into a grid. Each cell within the grid is associated with an aggregation of user actions and user characteristics, such as demographics. Such aggregation for a cell can be related to users residing within a geographical region and/or those transiting through it. The aggregation mapping can be extended to include the temporal dimension, with the individual and collective information within each cell divided further into appropriate temporal resolution based on time-of-day, day-of-week, etc.

If users permit, an app can query the context aggregator to retrieve a ranked list of relevant content, such as advertisements, to insert in the user's content stream within the app. The query specifies a time (e.g., in the near future) at which the additional content can be inserted within the stream. The response from the context aggregator can indicate if the specified time is suitable for the insertion of the additional content and list of businesses to advertise, ranked based on their contextual relevance.

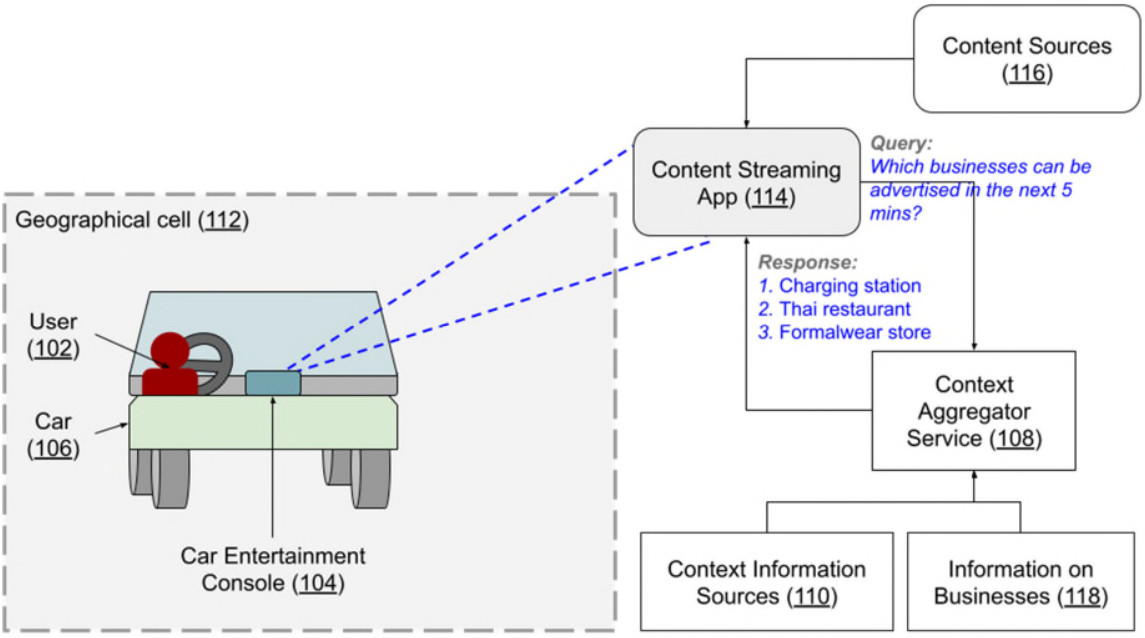

Fig. 1: Inserting personalized content in a stream by querying a context aggregator service

Fig. 1 shows an example of operational implementation of the techniques described in this disclosure. While driving a car (106) through a geographical region (112), a user (102) is listening to music via a content streaming app (114) on the car's entertainment console (104). The music (or other content) is obtained from content sources (116). In order to insert contextually relevant and personalized advertising content within the user's music stream at an opportune time with the user's permission, the app issues a query to a context aggregator service (108) to retrieve suitable advertisements that can be delivered, e.g., within the next five minutes.

The context aggregator service can access relevant context information (110) obtained with the user's permission, such as the current status of the user's car, sensor information from user devices, etc. With user permission the context information can be combined with data on businesses and their advertising preferences (118) to generate a response with a list of suggested businesses to advertise, ranked in the order of relevance. For instance, Fig. 1 shows that the user can be directed to a charging station to recharge the vehicle battery, a popular Thai restaurant in

the area, or a nearby formal clothing store to purchase clothes. The specific responses may be selected based on contextual information such as, e.g., the user's vehicle being an electric vehicle, the time being close to mealtimes, the user's calendar, etc., obtained with user permission.

The ranked list is based on individual or aggregate scores of users associated with a geographic cell, indicating user interest in a business type and/or individual business. The individual businesses need not be located within the cell itself. The interest scores are determined with user permission and can be separated into those for users residing within a cell and those transiting.

With user permission, interest scores can be determined based on a combination of the various pieces of aggregated contextual information as mentioned above. For instance, if a user is driving while consuming streaming content, the current state of the vehicle, such as fuel and battery levels, warning light states, etc. can be used to determine businesses of likely interest to the user. For example, if an electric vehicle is expected to run out of battery charge within the next hour (accessed and determined with user permission), the user can be considered highly likely to be interested in knowing about battery charging stations within a driving distance of less than an hour.

User-permitted interaction between an app and the context aggregator service can include additional query types and corresponding responses relevant for selecting content to insert within a user's content stream in the app. For instance, the query can seek a Boolean response to check whether a specific time is suitable for serving a specific advertisement to a specific user or to any user within a given geographic area. Additionally, queries can be utilized to narrow or rank a list of choices. For instance, a query can be used to identify the top business likely to match the

user's current interest (at a given time and place) from a list of multiple businesses that are among the advertisers. Moreover, for densely populated geographical areas with populations above a threshold, queries can be based on relevant specific contextual information and metrics. For instance, an app may query business types within a specified geographical area that are of highest user interest on weekends.

Optionally, and with user permission, the context aggregator service can determine whether the content it provided that was inserted within an app stream has an influence of subsequent user actions. For instance, information regarding user actions, obtained with permission, can indicate whether the user engaged with a previously advertised business in some form, such as traveling to the store of the business, shopping online on the website of the business, making a reservation connected to the business, scheduling a calendar event involving the business, etc. Analysis of individual or aggregated post-advertisement user actions within a particular geographic cell can indicate advertisement conversion, collective user interest, and unique preferences of individual users.

Further, if users permit, conversion information can be integrated as an additional factor in the calculation of the interest scores used to determine the relevance ranking of businesses as described above. In addition, analyses of conversion information can be applied for probabilistic insertion of random results within the ranked list provided for a given user to gauge the user's interest in new things.

Aggregating conversion metrics across users can simplify billing for the context aggregator service. While apps that use the context aggregator service can be charged per measured conversion for an advertisement returned and served to the users in response to app

queries, the app can be provided only with the total conversions for each geographic area in an aggregate form that does not reveal individual conversion information.

The query-response operation between apps and the context aggregation service can be implemented using an appropriate standard mechanism such as an application programming interface (API). Context aggregation can be provided by any platform or service that can obtain user-permitted contextual user information related to diverse applications and devices.

Implementation of the described techniques can help enhance the quality and relevance of app-inserted content within a user's content stream. When the inserted content includes advertisements for businesses, the techniques can help achieve better and contextually relevant matching between user interest and advertisements encountered within the content stream of an app, leading to higher likelihood of conversion. The techniques can result in users receiving more relevant advertisements, app makers generating higher advertising revenue, and businesses optimizing conversion rates of their advertising campaigns.

Further to the descriptions above, a user may be provided with controls allowing the user to make an election as to both if and when systems, programs or features described herein may enable collection of user information (e.g., information about a user's apps, social actions or activities, a user's media consumption, a user's vehicle, a user's preferences, or a user's current location), and if the user is sent content or communications from a server. In addition, certain data may be treated in one or more ways before it is stored or used, so that personally identifiable information is removed. For example, a user's identity may be treated so that no personally identifiable information can be determined for the user, or a user's geographic location may be generalized where location information is obtained (such as to a city, ZIP code, or state level), so that a particular location of a user cannot be determined. Thus, the user may have control over

what information is collected about the user, how that information is used, and what information is provided to the user.

CONCLUSION

Apps that stream content often interleave the personalized content broadcast with other information, such as advertisements, announcements, etc. Personalized and contextually optimal selection of such additional content is currently constrained by the information available to the specific app provider. This disclosure describes a context aggregator service that app makers can query to enhance the selection of inserted content by querying a broad variety of relevant contextual information, obtained with user permission. The context aggregator service can utilize individual and/or aggregated information to provide query responses, e.g., topics or advertisements that a user is likely to be interested in. If the user permits, the context aggregator service can further determine advertising conversion based on subsequent user actions and use the conversion metrics in interest score calculations.